**TOWN OF WARSAW**

**STANDARD SPECIFICATIONS**

**FOR**

**THE CONSTRUCTION OF WATER & SEWER**

**LINES AND RELATED WORK**

**PROJECT NO. 9151**

**FEBRUARY 2015**

PREPARED BY

R. STUART ROYER & ASSOCIATES AND SURVEYORS

8227 HERITAGE ROAD

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FEBRUARY 2015

Dear Developer and/or Contractor:

This document, STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF WATER AND SEWER LINE, FORCE MAINS AND RELATED WORK, presented to you by the Town of Warsaw, has been complied to assist you in the designing the most cost- and time- effective project in compliance with the Town’s needs. Our experience has proven that the more information we can present prior to project development, the greater assurance we have that the work will be acceptable to the Town, thereby assuring you – the developer and contractor – of the decreased likelihood of having to redesign or rework any portion of your project.

Herein you will find a Receipt of Regulations which the Town requires to be signed by all parties concerned, approved, and kept on file in the Town Office. Within the regulations you will find information highlighted for your convenience in identifying areas of particular concern – areas which have been the most likely to be problematic. Although the entire set of requirements is of the most importance to each of us, those highlighted might require your strict attention as your work proceeds.

The Town appreciates your efforts and looks forward to working with you. Please let our staff know of any questions or difficulties you might encounter.

 Sincerely,

 Joan Hadfield Smith

 Town Manager, Town of Warsaw

RECEIPT OF REGULATIONS FOR SUBDIVISION OR OTHER LAND DEVELOPMENT

The undersigned hereby acknowledge receipt of the Regulations of the Town of Warsaw for Subdivision or other Land Development. The Undersigned hereby also acknowledge responsibility for compliance with all regulations contained herein as well as for the compliance with all regulations referenced and including, but not limited to, the following:

1. Warsaw Water and Sewer Ordinance
2. Warsaw Zoning Ordinance
3. Warsaw Subdivision Ordinance
4. Warsaw Site Plan Development Ordinance
5. Warsaw Chesapeake Bay Area Overlay District Ordinance
6. Richmond County Erosion and Sediment Control Requirements
7. VDOT Standard Specifications for Road Additions
8. Department of Conservation & Recreation, Division of Soil & Water Conservation Stormwater Management Standards
9. Virginia Department of Health (attach approved plans)

In addition, the Undersigned provides assurance to the Town of Warsaw that complete and detailed construction plans shall be provided for official Town Review and Approval PRIOR to the commencement of ANY and ALL construction efforts (excluding structures).

The Undersigned further provides assurance to the Town that any change in construction plans shall be brought to the Town Office for prior approval and, if approved, shall be clearly recorded in detail and with the signature of those concurring on the construction plans provided for the Town’s official records.

The Undersigned finally acknowledges that, in the event of any discrepancy in the actual construction from the plans provided, any such discrepancy shall result in a **STOP WORK ORDER** until such discrepancy shall be resolved to the Town’s satisfaction and according to the Town Code, Ordinances and the Guidelines herein provided.

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 Developer and/ or Agent Signature Address and Telephone

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 Contractor and/ or Agent Signature Address and Telephone

DATE RECEIVED: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

DATE APPROVED: \_\_\_\_\_\_\_\_\_\_\_\_\_ TOWN OFFICIAL APPROVING

DATE CONSTRUCTION TO COMMENCE: \_\_\_\_\_\_\_\_\_\_\_

DATE CHANGES SUBMITTED: \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

DATE CHANGES APPROVED: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ TOWN OFFICIAL APPROVING

DATE OF FINAL DEVLOPMENT APPROVAL: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

DATE AS-BUILT PLANS RECEIVED: \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 APPROVAL

These regulations are subject to amendment without notice. It is the responsibility of the developer/ owner to maintain update.

TABLE OF CONTENTS

Page No.

Procedural Section 1

Review Checklist for Water & Sewer Line Exts. 2

Site Clearing 4

Trenching and Backfilling 6

Seeding 13

Water Line, Sewer Lines, & Appurtenances 18

Cast-in-Place Concrete 44

Standard Details

 D-100 Standard Precast Concrete Manhole-Sewer 8” to 12”

 D-120 Standard Drop Connection

 D-125 Special Acid Resistant Lining – For Manholes

 D-130 Alternate Manhole Top Details

 D-135 Standard Invert Details

 D-140 Standard Manhole Frame & Cover

 D-145 Vandalproof Manhole Frame & Cover

 D-150 Alternate Vandalproof Manhole Frame & Cover

 D-155 Watertight Manhole Frame & Cover

 D-160 Standard Manhole Step

 D-165 Typical House Connection Details

 D-200 Typical Fire Hydrant and Dead End Thrust Restraint Detail

TABLE OF CONTENTS

D- 210 Meter Installation Details

 D-215 Typical Water Meter Connection for ¾” & 1” Services

 D-220 1 ½” or 2” Disc Meter Settings

 D-230 Triple 2” Meter Setting

 D-235 4”, 6” and 8” F.M. Meter Setting

 D-240 4” Compound Meter Setting

 D-245 1 ½” or 2” Meter – 6” Detector Check Setting

 D-250 1 ½” or 2” Meter – 8” Detector Check Setting

 D-255 6” Detector Check

 D-260 8” Detector Check

 D-265 Standard Meter Vault Parts

 D-270 Ironcrete Meter Box

 D-275 Details – Blow-off

 D-275T Details – 2” Blow-off

 D-276 Air Release Valve Manhole

 D-300 Valve Box Detail

 D-325 Standard Pipe Pedestal

 D-330 Thrust Block Details

 D-350 Trench Bedding – I

 D-351 Trench Bedding – II

PROCEDURAL SECTION

1. These specification will be provided by the Town of Warsaw upon request for the cost of reproduction and handling.

2. These specifications may be used for projects to be built within the Town of Warsaw. Use of these specifications is limited to projects with 12” and smaller water line and gravity sewers 12”, 10”, and 8” in diameter on NON EPA funded projects. Project plans will be required for each project and will be prepared and submitted in accordance with the Commonwealth of Virginia Sewerage Regulations and the Waterworks Regulations. This includes both official regulations and any draft regulations.

3. All requests for deviation from these standard specifications will be set forth in writing and directed to the Town of Warsaw. Permission for same will be issued by the Town in the Form of a letter. A copy of the letter of permission will also be sent to the Commonwealth of Virginia State Department of Health.

4. The purpose of these specifications is to standardize the construction of water lines and sewer lines in the Town of Warsaw, Virginia.

5. The design professional who is responsible for the project must prepare project plans and has the responsibility of determining that all standard details and standard specifications are appropriate for the intended use. He also has the responsibility of station upon completion of project construction that all specified tests were performed with results within specific limits and that the project was built in accordance with the plans and specifications. The registered engineer must have a current license in the Commonwealth of Virginia in accordance with Title 54, Chapter 3 of Code of Virginia 1950, as amended.

6. Cross-connection and backflow prevention control is extremely important to the safe operation of the Town’s water system and as such all work involving it must be approved directly by the State Health Department.

REVIEW CHECKLIST FOR WATER AND SEWER LINE EXTENSIONS

WATERLINE

1. Waterwork Regulations section covered by Standard Specifications:
	1. 12.01 – Materials
	2. 12.04 – Installation of water lines
	3. 12.05 – Separation of water lines & sewer
	4. 12.06 – Valve, air relief, meter, and blow off chamber (show type on plans)
	5. 12.07 – Hydrants
	6. 12.09 – Water service & plumbing
	7. 12.11 – Disinfection of water lines
	8. 12.13 – Metering
2. Required Data supplied for each project:
	1. 7.06 – Capacity of Waterworks
	2. 12.02 – Minimum pipe size
	3. 12.03 – System design
	4. 12.08 – Surface water crossings
	5. 12.10 – Water pressure in system – hydraulic design data
	6. 12.12 – Cover
3. Sewerage Regulations sections covered by Standard Specifications:

Collection Lines

* 1. 21.05.01 – Minimum size
	2. 21.05.07 – Materials
	3. 21.05.08 – Joints & infiltrations
	4. 21.05.09 – Building sewers & connections
	5. 21.05.10 – Bedding
	6. 21.05.11 – Backfilling & tamping

Manholes

* 1. 21.07.02 – Material
	2. 21.07.03 – Measurement
	3. 21.07.04 – Foundation
	4. 21.07.05 – Flow channel
	5. 21.07.06 – Water tightness
	6. 21.07.07 – Connections
	7. 21.07.09 – Frames, Covers & steps
	8. 21.07.10 – Drop pipe – detail only
	9. 21.09.01 – Water supply interconnection
1. Required data supplied for each project:
	1. 21.04 – Design basis – design data

Collection Lines

* 1. 21.05.02 – Depth
	2. 21.05.03 – Slope
	3. 21.05.04 – Alignment
	4. 21.05.05 – Increasing size
	5. 21.05.06 – High velocity protection
	6. 21.10 – Property access

Manholes

* 1. 21.07.01 – Location
	2. 21.07.08 – Ventilation
	3. 21.07.10 – Drop pipe – where needed
	4. 21.09.02 – Relation to water works structures

**SITE CLEARING**

**1.0 GENERAL**

1.1 This section provides for general site clearing operations, including trees and vegetation removal, protection of existing trees to be left standing, and clearing and grubbing.

1.2 Related requirements specified in other Sections of the Specifications.

 A. Trenching & Backfilling

 B. Seeding

1.3 Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements not indicated to be removed, and improvements on adjoining properties.

A. Restore all improvements damaged by this work to their original condition, and acceptable to the Owner or other parties or authorities having jurisdiction.

1.4 Protect existing trees and other vegetation indicated to remain in place against cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.

1.5 Burning where allowed by local ordinances will be permitted.

**2.0 PRODUCTS**

2.1 Not Applicable.

**3.0 EXECUTION**

3.1 Clearing

A. Remove from the site trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation as well as fences, and incidental structures necessary to allow for new construction.

B. Clearing work shall be restricted to area within rights-of-way or easements or within “Construction Limits” indicated on Drawings.

3.2 Existing Trees and Shrubs

A. Trees and shrubs that are to remain within “Construction Limits” will be indicated on Drawings or conspicuously marked on site.

B. Ownership of Trees: Unless otherwise noted, trees within the “Construction Limits” shall become the property of the Contractor and shall be removed from the site.

3.3 Grubbing

A. Grub areas within and to a point 10 feet outside of all structures and pipe lines, areas to receive fill where finished grade will be less than 3 feet above existing grade, cut areas where finished grade will be less than 2 feet below existing grade, transitional areas between cut and fill, and any area to receive control fill.

B. Remove from the ground to a depth of 18 inches, all stumps, roots ½ inch and larger, organic material and debris.

C. Use only hand methods for grubbing inside the drip lines of trees which are to remain.

3.4 Clean up debris resulting from site clearing operations continuously with the progress of work.

3.5 Removes all waste material from site.

3.6 Remove debris from site in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt and debris at all times.

**TRENCHING & BACKFILLING**

1.0 **GENERAL**

1.1 Work included in this Section includes trenching and backfilling for underground pipelines and related structures only.

1.2 Related requirements specified in other Sections of the Specifications:

 A. Site Clearing

 B. Cast-in-Place Concrete

 C. Waterlines, Sewer Lines & Appurtenances

1.3 Reference Specifications are referred to by abbreviation as follows:

 A. American Society for Testing and Materials………………………….ASTM

B. American Assoc. of State Highway and Transportation Officials…………………………………………………………………………………AASHTO

C. Virginia Department of Transportation…………………………………VDOT

1.4 Use of explosives will not be permitted except where permitted in writing by the owner.

1.6 Owner will provide compaction testing, if in his opinion it is required.

1.7 Locate existing utilities, culverts and structures, above and/or below ground, before any excavation starts. Coordinate work with utility companies. Protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on Drawings or when locations differ from those shown on Drawings, notify Engineer for instructions before proceeding.

2.0 **PRODUCTS**

2.1 Pipe Bedding Fill

A. Granular fill shall meet requirements for coarse aggregates, Section 203, VDOT Specifications, size No. 57.

2.2 Select Backfill

A. Aggregate fill shall meet requirements for Coarse Aggregates, Section 203, VDOT Specifications size No. 68.

B. Clean earth fill shall be an approved material free of debris, roots, frozen materials, organic matter, rock or gravel larger than one inch in any dimension or other harmful matter.

2.3 Concrete for bedding, backfill or encasement shall be “Class C” 2,000 psi in accordance with Cast-in-Place Concrete.

2.4 Riprap where shown on the drawings shall conform to VDOT Specifications Sec. 414 “Dry Riprap – Class II.”

3.0 **EXECUTION**

3.1 Strip existing topsoil, leaf mold and organic materials, meeting topsoil requirements of Seeding. Deposit in storage piles separate from other excavated material.

3.2 Where the trench with exceeds the allowable width, the Contactor at his own expense shall provide for increased loads on pipe as directed by the Engineer.

3.3 Unauthorized excavation consists of the removal of material beyond indicated subgrade elevations or side dimensions with specific approval of the Engineer. Where unauthorized excavations occur, restore these areas to the elevations and dimensions shown on the Drawings with granular fill.

3.4 Where removal of unsatisfactory material is due to fault or negligence of the Contractor, by inadequate shoring or bracing, dewatering, material storage or other failure to meet specified requirements, any work deemed necessary by the Engineer to correct the faulty condition shall be performed at no additional cost to the Owner.

3.5 Excavation.

A. Open trenches only so far in advance of pipe laying as permitted by Engineer.

B. The width of the trench at and below the top of the pipe shall not exceed the outside diameter of the pipe plus 18 inches except that for pipe 12 inches or less in diameter, the trench width shall not exceed 33 inches.

C. Excavate trenches for gravity lines to elevations shown on Contract Drawings. Excavate trenches for pressure lines to elevations shown on Contract Drawings or to depths specified in other sections of this Division.

D. The bottom of the trench for pressure lines shall be shaped to fit the bottom of the pipe as shown in Stand Details.

 1. Excavate for bell holes at each joint.

2. Where rock is encountered, excavate 6 inches below the bottom of the pipe for bedding.

3. Where P.V.C. pipe is used excavation must accommodate class “C” bedding.

E. The bottom of the trench for gravity lines shall be as shown in standard Details.

F. Dewater excavation as necessary to provide proper protection. If deemed necessary, the Engineer may require continuous dewatering 24 hours per day by adequate pumpage or well-points until backfilling is completed. The method, and equipment used for dewatering shall be subject to the approval of the Engineer.

G. Where unsuitable soil is encountered, excavate to depth determined by Engineer and replace with select backfill thoroughly and uniformly compacted.

H. Where underground streams or springs are found, provide temporary drainage and notify Engineer.

I. Remove from project site and dispose of material unsatisfactory for backfill, trash, and all excess material continuously with the progress of the work.

J. Remove shoring and all form materials, unless ordered to remain.

K. Where rock is encountered so that a manhole, vault, or other structure will bear entirely on rock, it shall be used to support the foundation. Where only a part of the foundation would bear on rock, excavate to an even depth of 8 inches below the entire structure and backfill with aggregate fill and thoroughly compact.

L. Provide a minimum of 8 inches between rock excavation and sides of structures.

3.6 Pipe Bedding.

A. Except where otherwise shown on the Drawings, all gravity lines and P.V.C. pressure lines excavated in soil and all pipe lines excavated in rock shall be Class C bedding as shown in Standard Details.

B. Compact pipe bedding by tamping or rodding to prevent settlement.

3.7 Sheeting

A. Maintain trench walls in a safe condition at all times. The Engineer reserves the right to require the use of sheeting and/or shoring at any time the Engineer deems it necessary, however failure of the Engineer to require sheeting and/or shoring will not relieve the Contractor of his duty. The Engineer has no duty to determine whether a trench is safe.

B. Sheeting and shoring left in place shall be cut off to a depth of not less than 18 inches below grade.

C. all costs of providing sheeting and shoring shall be borne by Contractor.

3.8 Compaction

 A. Percentage of maximum density requirements.

1. Compact each layer of fill or backfill to not less than the following percentages of the maximum density at the optimum moisture content as determined by ASTM D 698 (AASHTO T-99) or ASTM D-1557 (Modified Proctor).

a. 100 percent beneath and within 25 ft. of buildings and structures, including those shown for future construction.

b. 95 percent beneath pavements, walks, and road shoulders, including those shown for future construction.

c. 90 percent in other unpaved areas.

3.9 Backfill

A. Backfill trench to a compacted depth of 1 foot over the pipe with select backfill in accordance with Standard Details drawing No. 350 and 351. Backfill shall be placed by hand uniformly on each side of the pipe and compacted in layers not exceeding 5 inches. Do not backfill on muddy or frozen soil, or with muddy or frozen soil.

B. Backfill trench from 1 foot above the pipe to grade with clean earth fill free of stones not larger than 5 inches of ½ the layer thickness, whichever is the smaller. Layers shall not exceed 12 inches, except that under road shoulders and under existing or future paved areas, layers shall not exceed 8 inches. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of this adjacent soil.

C. Excavate depressions caused by removal of stumps or other clearing operations to firm subgrade, fill with clean earth fill and compact as specified.

D. Place backfill materials evenly adjacent to structures. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.

E. Compact soil materials using equipment suitable for materials to be compacted and work area locations. Use power-driven hand tampers for compacting materials adjacent to structures.

F. Compact aggregate fill placed under manholes or other structures to required density.

3.10 Grading

A. Uniformly grade all areas within the limits designated on the Drawings, including adjacent transition areas. Finish surfaces within specified tolerances with uniform levels or slopes between points where elevations are shown and existing grades.

B. Finish all surfaces free from irregular changes.

C. Finish subgrade areas to receive topsoil to within 0.10 foot of required subgrade elevations.

D. Shape subgrade under walks to line, grade, and cross-section to within 0.10 foot of required subgrade elevations.

E. Shape subgrade under pavement to line, grade, and cross-section to within ½ inch of required subgrade elevations.

F. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.

G. Where compacted areas are disturbed by subsequent construction or adverse weather; scarify the surface, reshape and compact to the required density. Use hand tamper for recompaction over underground utilities.

3.11 Utilities to be Abandoned or Removed

A. When underground utilities are to be abandoned in place, plug, cap, or seal with concrete at the “construction limits” or at points shown.

B. Remove underground utilities indicated on the Drawings to be removed and backfill resulting excavation with suitable material, compacted as specified. Plug, cap or seal utilities with concrete, at the construction limits or at points shown.

3.12 Erosion Control

A. Comply with Richmond County Erosion and Sediment Control regulations and requirements and the “Virginia Erosion and Sediment Control Handbook” by the Virginia Soil and Water Conservation Commission t control erosion and sedimentation.

B. All applicable erosion and siltation control measures shall be taken prior to grading.

C. No more than 500 feet of trench shall be open at any one time.

D. All utility lines, not in streets, shall be mulched with hay or straw and seeded within 7 days after backfill.

E. Any disturbed area, not paved, sodded or built upon by November 15 is to be seeded on that date with oats, abruzzi rye, or equivalent and mulched with hay or straw.

F. Protect graded areas from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work shall be repaired and grades satisfactorily reestablished.

G. Repair after cleanup: Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by operations.

H. Stormwater management shall be coordinated and approved through the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.

3.13 Clean Up

A. Keep area of Work cleaned up at all times and promptly remove all materials and debris not intended for incorporation in the Work. Broom clean the surfaces of all paved areas immediately after backfilling operations.

B. Maintain backfilled trenches from the nuisance of dust, mud or settling during the entire length of the Contract and for a period of one year following the Final Acceptance of the Work.

C. In the event the Contractor fails to satisfy these requirements to the satisfaction of the Engineer, or otherwise prosecute the Work in a reasonable or proper manner, and after a reasonable period of time has elapsed after notifications by the Engineer of unsatisfactory conditions, the Owner reserves the right to employ outside services to take such corrective action as deemed necessary by the Engineer. The cost incurred in taking corrective actions will be deducted from any monies due the Contractor by the Owner or such other means of collection as may be available to the Owner.

3.14 Preparation for Final Inspection

A. Locate and adjust all manholes, valve boxes, etc. to final grade and flush out all gravity pipe lines as necessary prior to final inspection by the Engineer. The costs of this work shall be included in the applicable bid prices.

3.15 Existing Driveways, Fences, Culverts, etc.

The Contractor shall return all driveways, fences, culverts, lawn areas, paved areas, etc. to the same condition existing prior to construction. Any culverts damaged during construction shall be replaced with new culverts at no cost to the Owner.

3.16 The Contractor shall obtain a permit from the Highway Department prior to any construction on Highway Right-of-Way.

END OF SECTION

**SEEDING**

**1.0 GENERAL**

1.1 Related requirements specified in other Section of the Specifications.

 A. Trenching & Backfilling

1.2 Reference Specifications are referred to by abbreviations as follows.

 A. American Society for Testing and Materials……………ASTM

1.3 Submit two copies of following:

 A. Seed Test Report

 B. Fertilizer Analysis

1.4 Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents. Seed, limestone, and fertilizer shall be labeled as to proportions, analysis and quality. Store all materials in manner affording protection from damage by weather or vandalism.

1.5 Seed only when wind velocity is less than 15 miles per hour.

**2.0 PRODUCTS**

2.1 Topsoil shall be the top 6 inches of original soil from the site, unless otherwise noted on the Drawings. Topsoil obtained off-site shall be fertile, friable loam, containing not less than 2 pct., by weight, of finely divided, decomposed vegetable matter. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than ½ inch diameter, stones larger than ½ inch diameter and other material toxic or harmful to growth.

2.2 Fertilizer shall meet requirements of Federal Specification 0-F-241. Provide fertilizer that is complete, inorganic, uniform in composition and suitable for application with approved equipment.

 A. Proportions of fertilizer nutrients shall be the following:

 1. 5lbs. of actual nitrogen

 2. 10 lbs. of actual phosphate

 3. 5 lbs. of actual potash

2.3 Grass seed, tested within 6 months of sowing, shall have the following characteristics.

 A. Permanent Seeding

 Species % (Minimum)

 Wgt. Pur. Germ.

 1. Kentucky 31 Tall Fescue 90 98 90

 2. Merion Kentucky Bluegrass 5 90 75

 3. Kenblue Kentucky Bluegrass 5 85 75

 B. Temporary Seeding

 Seeding Date Species % Minimum Rate/Lb.

 Wgt. Pur Germ Ac.

 1. Feb 15- Apr 30 Oats 100 98 85 96

 2. May 1- Aug 31 Millet 100 98 80 40

 3. Sept 1- Nov 15 Rye 100 96 85 140

2.4 Lime shall be ground agricultural grade limestone containing not less than 85 pct. calcium and magnesium carbonates. Fineness shall be such that 100 pct. will pass a No. 20 sieve, not less than 50 pct. will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.

2.5 Type I mulch shall be Propex, Inc. Landlok S2 erosion control blanket. The fabric shall be manufactured of materials which degrade in 6 to 8 months under outdoor exposure.

2.6 Type II mulch composed of threshed straw of cereal grain, pine needles or wood fiber shall be free of objectionable weed seeds or other harmful material.

2.7 Asphalt adhesive for use with Type II mulch shall be emulsified asphalt meeting requirements of ASTM D977, Grade SS-1.

2.8 Sod shall be composed of at least 70 pct. of Kentucky 31 tall fescue and be cut to provide a minimum thickness of 2 inches. Vegetation more than 5 inches in height shall be cut to 3 inches or less before sod is lifted.

**3.0 Execution**

3.1 Temporary Seeding

A. Use in areas when final grading has not been completed or when permanent seeding cannot be done due to the specified permanent seeding dates. Also use in easements where no permanent seeding is required as shown on Drawings.

B. Apply fertilizer at a rate of 15 lbs. of 10-20-10 per 1000 sq. ft. (600 lbs. per acre) or equivalent.

C. For loose soil, work lime and fertilizer into soil and then seed. For packed or hard soil, loosen top layer while working lime and fertilizer into soil and then seed at the rate required for the temporary seeding species.

D. Seed only between February 15 and November 15. Use oats, abuzzi rye, or equivalent and mulch with hay or straw between November 15 and February 15.

3.2 Prepare soil for permanent seeding by tillage of topsoil in place to loosen thoroughly and break up all clods to a depth of 6 inches. Remove all stumps and roots, coarse vegetation, stones larger than 1 ½ inches and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4 inches. Rake to a uniform, smooth and drainable surface.

A. Apply lime and fertilizer uniformly and mix well into top 4 inches of seed bed. Apply lime at the rate of 100 lbs. per 1000 sq. ft. Apply fertilizer at the rate of 50 lbs. of 5-10-5 per 1000 sq. ft. or 25 lbs. of 10-20-10 per 1000 sq. ft. Rates should be adjusted for other grades of fertilizer.

3.3 Sow permanent grass seed between dates of March 1 and April 15 or September 1 and October 15.

3.4 Sow permanent seed by mechanical seeder as follows:

A. Mix seed thoroughly with clean dry sawdust and broadcast at rate of 6 lbs. of seed per 1000 sq. ft. in cross directions to ensure uniform distribution. Rake surface lightly and roll with appropriate type of lawn roller weighing maximum of 150 lbs. per foot of width.

B. Apply either Type I or Type II mulch uniformly leaving not more than 10% of the soil surface exposed.

1. Type I mulch. Apply in accordance with manufacturer’s instructions.

2. Type II mulch. Apply uniformly to depth of approximately 1¼ inches uniformly leaving not more than 10% of the soil surface exposed.

 C. Anchor mulch by the following methods.

 1. Apply light tack coat of asphalt emulsion.

2. In residential areas, apply synthetic mulch binder at rate recommended by manufacturer.

3. On slopes steeper than 4 horizontal to 1 vertical, fasten heavy jute mesh to wooden stakes.

3.5 Remove all soiling or staining of finished walks, drives and parking areas resulting from seeding work. Maintain paved areas in clean condition.

3.6 Turfgrass Maintenance

 A. Water as required to keep soil moist during germination period.

 B. Mowing

1. When grass reached height of 3 ½ to 4 inches, mow to height of 2 ½ inches.

2. Maintain grass height between 2 ½ and 4 inches.

3. Do not remove more than 33 pct. of total height of grass in one mowing.

C. Reseed and mulch spots larger than 1 sg. ft. without uniform stand of grass.

D. Mow and maintain all seeded areas until uniform stand of grass is acceptable to Engineer.

E. In the event that growth is not established by final project inspection, continue the specified attention until stand is accepted by Engineer.

F. Correct or repaid all undue settling as evidenced by complaints received within one year after final inspection.

END OF SECTION

**WATER LINES, SEWER LINES, & APPURTENANCES**

**1.0 GENERAL**

1.1 Work in this section includes the following:

 A. Water distribution piping and appurtenances.

 B. Gravity sanitary sewers and appurtanances.

 C. Sewage Force Mains and Appurtenances

1.2 Related requirements specified in other Sections of the Specifications:

 A. Site Clearing

 B. Trenching & Backfilling

 C. Seeding

 D. Cast-in-Place Concrete

 E. Standard Details

1.3 Reference Specifications are referred to by abbreviations as follows:

 A. American National Standards Institute………………………….ANSI

 B. American Society for Testing and Materials…………………..ASTM

 C. American Water Works Association………………………………AWWA

 D. Virginia Department of Transportation………………………….VDOT

 E. Commercial Standard (National Bureau of Standards……….CS

1.4 Submit shop drawings of the following:

 A. Pipe

 B. Valve

 C. Valve Boxes

 D. Fire Hydrants

 E. Air and Vacuum Valves

 F. Flexible Couplings

 G. Manholes and Accessories

 H. Manhole Frames and Covers

 I. Dimensioned Piping Layout for Flanged Piping

 J. Pressure Gages

 K. Blow-Offs

1.5 Submit Certificate of Compliance for all Products specified by reference standard.

1.6 The Owner will provide the services of an independent testing firm to verify the testing of pipe.

1.7 Provide certified test results of pipe testing.

1.8 Separation of water lines and sewers.

A. Follow State Health Department “Waterworks Regulations” for separation of water lines and sewer lines.

 B. Parallel Installation

1. Normal Conditions – Water lines shall be laid at least ten feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.

2. Unusual Conditions – When local condition prevent a horizontal separation of at least ten feet, the water line may be laid closer to a sewer or sewer manhole provided that:

a. The bottom (invert) of the water main is at least eighteen inches above the top (crown) of the sewer.

b. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved pipe, hydrostatically pressure tested in accordance with the most recent edition of the AWWA Standards, with a minimum test pressure of 30 psi, in place without leakage prior to backfilling.

c. The sewer manhole shall be of watertight construction and tested in place.

 C. Crossing

1. Normal Conditions- Water lines crossing sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.

2. Unusual Conditions- When local conditions prevent a vertical separation described in “Crossing, Normal Conditions,” the following construction shall be used.

a. Sewers passing over or under water lines shall be constructed of the materials described in “Parallel Installation, Unusual Conditions.”

b. Water lines passing under sewers shall, in addition, be protected by providing:

1. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.

2. Adequate structural support for the sewers to prevent excessive deflection and settling.

3. That the length of the water line shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

D. Sewers or sewer manholes – No water pipes shall pass through or come in contact with any part of a sewer manhole.

2.0 PRODUCTS

2.1 Ductile iron pipe shall meet requirements of AWWA/ ANSI C151/ A21.51 for the pressure and thickness class indicated on the Drawings. Thickness Classes shall meet requirements of AWWA/ANSI C150/A21.50. All pipe shall have a cement mortar lining and seal coat, meeting the requirements of AWWA/ANSI c104/A21.4 on the interior and a bituminous seal coat on the exterior.

2.2 Flanged cast iron and ductile iron pipe shall meet the requirements of AWWA/ANSI C115/A.21.15 for the pressure and thickness class indicated on the Drawings. All pipe shall have a cement mortar lining and seal coat, meeting the requirements of AWWA/ANSI c104/A21.4 on the interior and a bituminous seal coat on the exterior.

2.3 Polyvinylchloride (PVC) pressure pipe and fittings in size 4 inches through 12 inches for waterworks service when used shall meet the requirements of AWWA C900, CIP OD, Class 200 except that all connections shall be made using elastomeric gasket joints.

2.4 Polyvinylchloride (PVC) non-pressure sewer pipe and fitting in sizes 4 inches through 15 inches shall meet the requirements of ASTM Standard D3034 SDR 35, Type PSM with flexible elastomeric seals conforming to ASTM Standard F477.

2.5 Copper tubing for waterworks service shall meet requirements of ASTM B88 for Type “K” copper, hard drawn, for above ground and Type “K” soft drawn for services smaller than 1 ½ inch below ground.

2.6 Cast iron and ductile iron fitting shall meet requirements of AWWA/ANSI C110/A21.10. Pressure ratings shall be a minimum of 250 psi for fittings 12 inch and smaller and at least 150 psi for fittings 14 inch and larger, or pressure specified for adjacent piping, whichever is greater. All fittings shall be all bell, mechanical joint, or mechanical joint plain end unless otherwise approved by the Engineer. All fittings shall have a cement mortar lining and seal coat, meeting the requirements of AWWA/ANSI c104/A21.4 on the interior and a bituminous seal coat on the exterior.

2.7 Mechanical joints and jointing materials shall meet requirements of AWWA/ANSI C11/A21.11

A. Mechanical Joint retainer glands shall meet requirements of AWWA/ANSI C11/A21.11 except that retainer gland shall be modified to accommodate set screws.

B. Locked type mechanical joints may be used where restrained joints are required.

2.8 Push-on joint and rubber gasket shall meet requirements of AWWA/ANSI C111/A21.11.

A. Restrained push-on joints may be used where restrained joints are required.

2.9 Flanged joint gaskets shall be full-face, made of rubber, and shall meet requirements of ANSI B16.21.

2.10 Cement mortar lining with bituminous seal coat for cast iron or ductile iron pipe and fittings shall meet requirements of AWWA/ANSI C104/A21.4.

 A. Cement mortar lining shall be standard thickness.

2.11 Exterior, bituminous coating for ductile iron pipe and fittings and cast iron fittings shall meet requirements of C151/A21.51 as applicable.

2.12 Metal harness shall be bituminous coated galvanized rods and clamps as detailed on Drawings.

2.13 Fittings for above ground copper piping shall meet requirements of ANSI B16.22 for wrought copper, sweat joint. Fittings for buried copper piping shall meet requirements of AWWA C800.

2.14 Blow-off shall be as follows:

 A. For lines 6-8 inches – conform to Standard Drawing D-275.

B. For lines 4 inches and smaller, blow-off shall be Kupferle Foundry Company Main Guard Model No. 78 with 2 ½ inches FHT and a 2 inch FIP inlet.

2.15 Gate valves should be as follows:

A. Non-rising stem gate valves, 3 inches and larger shall meet requirements of AWWA C500. Valves shall be for at least 200 psi working pressure in sizes larger than 12 inch or pressure rating specified for adjacent piping whichever is greater. Valve ends shall be compatible with piping systems in which valves are installed. Valve shall be cast iron body, bronze mounted with double parallel disc and bronze stem. Valve shall have O-ring seals and open counter-clockwise.

B. Outside screw and yoke valves 3 in. and larger shall meet requirements of AWWA C500. Valves shall be for at least 200 psi working pressure in sizes 3 through 12 inch and for at least 150 psi working pressure in sizes larger than 12 inch or pressure rating specified for adjacent piping whichever is greater. Valve ends shall be compatible with piping systems in which valves are installed. Valves shall be cast iron body, bronze mounted with double parallel disc and bronze stem and shall open counter-clockwise.

C. Square bottom gate valves designed for throttling service shall be installed at location indicated on Drawings.

D. Manufacturer shall be Clow Corporation, Kennedy Valve Company, M&H Valve Company or Mueller Company.

E. Gate valves smaller than 3 inches shall be bronze, solid wedge, rising stem, at least 200 psi working pressure Crane Company Jenkins Model 2270UJ threaded ends.

F. Tapping valves shall meet requirements of gate valves specified above except that seat opening shall be larger than nominal size and valve outlet end shall have mechanical joint.

2.16 Butterfly Valves

A. Butterfly valves may be used on lines 16 inches and larger in diameter. Butterfly valves 3 inches and larger shall meet requirements of AWWA C504. Valves shall be for the pressure class 150B or classes indicated on Drawings. Wafer-type valves shall not be used underground.

B. Valve end connections shall be mechanical joint or flanged joint compatible with piping systems in which valves are installed.

C. Valve operating mechanism shall be of the traveling-nut type, sealed, gasketed and lubricated. Valves to be installed underground shall be suitable for buried service. Valve operator shall be AWWA Standard operating nut or handwheel as shown on the Drawings.

D. Valves shall open counter-clockwise.

E. Valves shall be factory-tested in accordance with Section 12 of AWWA C504 specification and upon request the manufacturer shall furnish certified copies of test reports.

F. Valves shall be Henry Pratt Company, Kennedy Valve Company, M& H Valve Company, Clow Company, Pratt or approved equal.

2.17 Check valves 3 inches and larger shall be iron body, bronze mounted, swing check valves, meeting requirements of AWWA C508. Check valves 3 through 12 inches shall be for 175 psi nonshock cold water working pressure. Valves 14 through 24 inches shall be for 150 psi nonshock cold water. Valves shall have outside weight and lever.

A. Henry Pratt Company, Kennedy Valve Company, M&H Valve Company, Clow Company, or GA Industries, LLC.

2.18 Pressure Reducing Valve

A. Valves shall be hydraulically operated and of self-contained, differential piston type. The valves shall function to reduce high upstream pressure to a predetermined lower downstream pressure without shock or hammer.

B. The valve shall be air and water cushioned and when required, provide tight valve closure. When required, the valve shall open wide to permit full pipe line opening. An indicator shall be furnished as an integral part of the valve to show piston position within the body.

C. The valves shall be cast iron body. The piston shall be of cast bronze provided with renewable leather or composition cup and seat. The valve liner shall be of cast bronze provided with a leather or composition cup. The valve shall be provided with “V” shaped ports for low passage downstream of the seat opening. The valve assembly shall be so constructed as to permit removal of the piston or liner from the valve body without removing the valve body from the line.

D. The pilot valve shall be of the single seated, globe body pattern, diaphragm operated and spring loaded with convenient discharge pressure setting over a range no less than 30 psi.

E. Valves in sizes 3 – 12 inches shall have a minimum working pressure of 175 psi. Valves in sizes 4 inches and up shall have a minimum working pressure of 150 psi. Valves shall be provided with 125 lb. STD drilling ANSI flanges and shall be GA Industries, LLC., Fig. No. 4500-D

2.19 Air and vacuum valves for water service shall conform to AWWA C512 and shall be constructed with cast iron bodies, stainless steel floats, bronze trim and Buna-N seats. Valves shall be of the size and the locations indicated on the Drawings. Valves shall be of combination type to relieve large volumes of air as the lines are filled or emptied and also release small quantities of entrained air under pressure. Valves shall be for working pressures indicated on Drawings. Manufacturers shall be Valve & Primer Corp., Val-matic Valve & Manufacturing Corp., GA Industries, LLC.

2.20 Air release valves and air vacuum valves for sewage service shall be of the sizes and located as indicated on Drawings, shall have cast iron body and cover, bonze mechanism and seat, Buna-N needle and stainless steel float and lever pins. Valves shall have valved quick coupling back flushing connection. Valves shall be Valve and Primer Corp. Series 401 SAVV or Val-Matic & Manufacturing Corp. Model 301ABW.

2.21 Fire hydrants shall conform to the requirements of AWWA Standard C502, Latest revision for “Dry Barrel Fire Hydrants” and shall comply in full with the following requirements.

 A. Fire hydrants shall be installed on 6 inches or larger lines only.

B. Hydrants shall be of the three post type of dry top design rated 150 psi with compression main valve opening counter-clockwise against pressure. Each hydrant shall have a 6” standardized, mechanical joint inlet connection with accessories. The internal valve shall provide a minimum of 4 ½“ unobstructed flow area. Each hydrant shall be designed to allow the removal of all operating parts through the standpipe without excavation. Each hydrant shall be constructed with an oil lubricated dry type bonnet with “O” ring seals above and below operating threads.

C. The standpipe sections shall be connected at the ground line by a two-part safety flange that prevents damage to the barrel sections when the hydrant is struck by a vehicle. The standpipe and safety flange design shall permit rotation of the hydrant nozzles to any desired position without excavation or disassembly of the operating components. Threaded joints, above or below ground, or breakable bolts will not be allowed for the barrel assembly.

D. The main valve operating rod shall be designed with a travel stop so that the rod cannot be placed in compression. Travel stops located at the bottom of the hydrant will not be acceptable. The operating rod threads stop and bottom shall be isolated from contact with water in bonnet or in the inlet shoe. A safety stem coupling on the operating rod shall be placed at the ground line.

E. The drain mechanism shall be co-related with the operation of the main valve to provide a momentary flushing of the drain ports each time the hydrant is opened. The drain ports shall be fully closed when the hydrant valve is more than 2 ½ turns open. The drain ports shall be fully open with the hydrant is in the closed position. Notify Town and seal drain ports in areas where high ground water is encountered. Where drain ports are sealed, the Town will need to pump barrels dry after each use to prevent freeze damage.

F. The nozzle outlets shall consist of two (2) 2 ½” hose nozzles 180⁰ apart and one (1) 5” steamer connection. The nozzle threads shall conform to Warsaw Standard. The nozzle caps shall be individually attached to the standpipe with heavy duty non-kinking chains that permit free turning of the cap. The operating nut and cap nuts shall be National Standard pentagon with 1 ½” from point to flat.

G. The exterior of the hydrants above the ground line shall be shop painted red.

H. Fire hydrants shall be Mueller Company Model A-421 “Centurion”, Kennedy Valve Division of McWane, Inc. K-81-A “Guardian”, or an approved equal.

2.22 Valve boxes shall be adjustable cast iron valve boxes of the three piece type, consisting of lid, two piece sliding extension and base. Base shall be proper type and size for the valve with which it is used. The word “Water” or “Sewer” shall be cast or embossed on the valve box lid in letter not less than 1 inch high. Valve box shall be manufactured by Mueller Company, Tyler Union Division of McWane, Inc.

2.23 Tapping sleeves shall meet requirements of AWWA C110 for pressure ratings shown on the Drawings. Sleeves shall be built in two sections and shall be mechanical joint type with flanged outlet. The tapping sleeves shall be for the size and type of pipe shown on the Drawings.

2.24 Pressure gages shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4 ½ inch white coated dial graduated from 0 to 100 psi. Gages shall be Ashcroft No. 1279 or equal.

2.25 Compound gages shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4 ½ inch white coated dial graduated from 0 to 100 psi and 0 to 30 inch vacuum.

2.26 Globe valves smaller than 3 inches shall be bronze construction with bronze plug type discs and threaded joint ends.

2.27 Water service connection accessories shall consist of corporation stop, meter box and meter yoke in accordance with the following: Meter yoke shall be Ford Meter Box Co. Model VHH 72-12W or equivalent including dual check valve or backflow containment.

2.28 Water service connection shall in accordance with the uniform statewide building code.

2.29 Detectable tape shall have a metallic core, 14 ga. Or larger protected by a plastic jacket or 6 mil or thicker detectable tape with 65# tensile strength 3” wide, blue in color with wording ‘Water Line Below” as appropriate. The tape shall be continuously marked indicating that a non-metallic pressure pipe is buried beneath the tape.

2.30 Tracer Wire shall be 12 gage or larger.

2.31 Manholes

A. Manholes shall be constructed of precast reinforced concrete manhole sections in accordance with the requirements of ASTM C478 and detailed in Standard Details.

 B. A maximum of two lift holes per manhole section may be provided.

C. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket.

 1. Gasket shall comply with requirements of ASTM C361.

2. Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.

 D. Provide flexible pipe connections to manholes.

1. Materials shall be resistant to water, sewage, acids, ozone, weathering and aging. Use neoprene conforming o ASTM C443. Band assembly and toggle expander shall be 300 series stainless steel.

2. Cast or core drill openings in manholes to receive connectors. Connectors shall be suitable for field repair or replacement. Connectors not suitable for field replacement are unacceptable.

3. The assembeled connectors shall allow at least an 11 deg. Angular deflection of the pipe and at least one inch of lateral misalignment in an direction and be suitable for a normal variation in diameter or rounded for the pipe material used.

4. Connectors shall be Kor-n-Seal II, as manufactured by NPC, Inc., or equal.

E. Liners for acid-resistant manholes shall be of fiberglass reinforced polyester or polyvinylchloride construction and shall be installed to protect the precast manhole sections from the inside base of the manhole to the base of the manhole frame.

1. FRP liners shall consist of a 3/16 inch think fiberglass reinforced polyester with a 15 mil gel coat interior surface. The polyester resin shall be Reichold, Inc. Dion No. 6694, or equal. Joints between sections of the liner shall be sealed with joint sealant.

2. PVC liners shall consist of polyvinylchloride plates, not less than 0.060 in. thick, with integral bonding ribs and shall be A-Lok Products, Inc. Dura Plate 100 Liner System, or equal. Joints between sections of liner shall be welded in accordance with the manufacturer’s instructions.

F. Joint Sealant shall be a one-component polyurethane Sika Corp. Sikeflex 1A, or equal.

G. Manhole steps shall be corrosion-resistant and shall be one inch square cast iron, rubber-covered steel or rubber coated aluminum. The steps shall conform to the dimensions shown in Standard Details.

H. manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Standard Details.

1. Standard Manhole Frame and Cover shall be Neenah Foundry Co. No. R-1500, or equal.

2. Vandalproof Manhole Frame and Cover shall be Neenah Foundry Co., Cat. No. R-1926-C, or equal with 4 – 1 in. diameter vent holes.

3. Watertight Manhole Frame and Cover shall be Neenah Foundry Co. No. R-1755-E1, or equal.

2.32 Wall sleeves and seals, for pipe wall and floor penetration, shall be Link-Seal Century-Line Model CS sleeve, with Link-Seal Model OS-316 modular seal, as manufactured by Farwest Corrosion control Company, or Equal

2.33 Thrust blocking shall be as shown in Contract Documents or as directed by the Projects Representative based upon field conditions. Concrete shall be Class “B” 3000 psi strength at 28 days in accordance with Cast-in-Place Concrete and shall meet requirements of ASTM C94.

2.34 All manholes must be precast where conditions allow. If precast bases cannot be used, masonry may be used only to a point equal to the top line of the pipe. Brick of block manhole risers will be allowed only by special permission in writing from the Owner, and then any block or brick riser or base must be plastered both inside and out and then coated both inside and out with a waterproofing product approved by the Owner.

**3.0 EXECUTION**

3.1 Pipe Laying, General

A. Take all precaution necessary to insure that pipe, valves, fittings, and other accessories are not damaged in uploading, handling, and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

B. Exercise care to keep foreign material and dirt from entering pipe during storage, handling, and placing in trench. Close ends of in-place pipe at the end of any work period to preclude the entry of animals and foreign material.

C. Bed pipe as specified in Trenching and Backfilling.

D. Do not lay pipe when trench bottom is muddy or frozen, or has standing water.

E. Use only those tools specifically intended for cutting the size and material and type pipe involved. Make cut such as to prevent damage to pipe or lining and to leave a smooth end at right angles to the axis of the pipe.

3.2 Lay gravity sewers so as to maintain a true alignment and grade as indicated on Drawings. After completion, the pipe shall exhibit a full circle of light when lighted at one manhole and viewed from the next.

A. Commence laying gravity sewers at the lowest point on a section of line and lay pipe with the bell ends uphill.

B. Pipe Joint. Preparatory to making pipe joints on gravity sewer lines, clean and dry all surfaces of joint pipe and jointing materials. Use lubricants, primers, adhesives and similar materials as recommended by the manufacturer. Place, fit, join and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of watertightness required. As soon as possible after the joint is made, place sufficient backfill material, as specified under Trenching & Backfilling, along each side of the pipe to resist forces that might tend to move the pipe off line and grade.

C. Complete backfilling as specified under Trenching & Backfilling. Place backfill over the pipe immediately after the pipe has been laid.

D. Surface water crossings shall be as shown in Drawings D-167 in the Standard Details.

3.3 Install pressure line with a minimum depth of cover of 42 in. over the top of the pipe, where no grades are shown on the Drawings.

A. Where grades on the pressure line conflict with existing pipes or structures, lay pressure line to additional depth with a uniform vertical curve to provide proper clearance without the use of fittings. No additional payment will be allowed for additional exaction. Provide allowance for expansion as directed by Engineer.

B. Lay pressure line pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, pipe shall be laid uphill with bell ends upgrade.

C. Termination of force main into manholes shall be as shown on Drawing D-166 in the Standard Details.

D. Surface water crossings shall be as shown in Drawing D-167 in the Standard Details.

3.4 Joining Mechanical Joint Pipe

A. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter. Paint the bell and the spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.

B Push the spigot end forward to seat in the bell. Then, press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts and screw nuts up finger tight. Then tighten all nuts to torque listed below:

 Bolt Sizes- Inches Torque Ft.- Lbs.

 5/8 40-60

 3/4 60-90

 1 70-100

 1 ¼ 90-120

 Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed.

C. Join lock-type mechanical joint pipe according to manufacturer’s recommendations.

D. Permissible deflection in mechanical joint pipe shall not be greater than 2/3 of that listed in AWWA C600.

E. Permissible deflection in lock-type mechanical joint pipe shall be as recommended by manufacturer.

3.5 Joining Push-On Joint Pipe

A. Thoroughly clean inside of the bell and 8 inches of the outside of spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by pipe manufacturer, to either the gasket or the spigot end of the joining pipe. Start the spigot end of the pipe into the socket with care. Then complete the joint by forcing the plain end to the

 bottom of the socket with a forked tool or jack-type device. File the end of the field cut pipe to match the manufactured spigot end.

B. Permissible deflection in push-on joint pipe shall not be greater than 2/3 of that listed in AWWA C600.

C. Join restrained push-on joints according to manufacturer’s recommendations.

D. Permissible deflection in restrained push-on joint pipe shall be as recommended by manufacturer.

3.6 Join PVC pipe and fittings in accordance with manufacturers’ instructions and install in accordance with ASTM D2321.

3.7 Join copper pipe using flare or compression joints. Does not use lead solder. Silver solder may be used upon request.

3.8 Setting Valves and Valve Boxes

A. Install valves with operator stems in the horizontal or vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on Drawings. Thoroughly clean valves before installation. Check valves for satisfactory operation.

B. Equip all underground valves with valve boxes where shown on the Drawings. Set valve boxes in accordance with Standard Details. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground surface or pavement.

C. Construct manholes for all underground valves where shown on the Drawings. Construct manholes so as to prevent transmitting any load or shock to the valve or pipe. Locate manholes and valve relative to each in order that packing, operator and other parts of the valve are readily accessible for minor repairs.

3.9 Locate Fire Hydrants as shown on Drawings and in accordance with Standard Details.

3.10 Provide air and vacuum valve at locations shown on Drawings. Install gate valve between pressure line and relief valves. Construct manholes for air and vacuum relief valve shown on Drawings.

3.11 Use sleeves where pipes, valve stem extensions or equipment parts pass through concrete or masonry walls or slabs. Sleeves shall be either cast iron or schedule 40 steel of sufficient size to allow sealing around pipes and clearance for valve stems or equipment. Extend vertical sleeves through slabs 1 inch above top surface.

A. Use cast iron sleeves with intermediate collars to anchor and provide a water stop on outside of sleeves that go through exterior walls below grade. Seal pipe using oakum and leadite.

B. Provide “Link-Seal” for pipe to wall closures as manufactured by Thunderline Corp., Wayne, Michigan where shown on Drawings. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill annular space between pipe and wall opening to provide water-tight seal between pipe and wall opening.

3.12 Provide reaction anchors of concrete blocking, metal harness, retainer glad type or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on Drawings.

A. Concrete reaction anchors shall bear against undisturbed earth and shall be as shown on Drawings.

B. Use metal harness restraints as shown in Standard Detail.

C. Where retainer gland or rod and clamp restraints are used, extreme care shall be taken to that each bolt is tightened as recommended by the manufacturer before the pipe is backfilled and tested.

3.13 Installation of Tapping Sleeves and Tapping Valves

A. All tapping sleeves shall be set to avoid interference with existing pipe joints.

B. After all tapping sleeves and valves have been set in place, a pressure tests in accord with Article 3.21, Paragraph C of the section shall be made to insure that there are no leaks around the sleeve or through the valve. All leakage shall be corrected.

C. The actual tap shall be made in presence of a representative of the Owner. The Owner shall be notified 48 hours in advance of making the tap.

3.14 At all dead end lines install a valve and cap. Restrain cap using rods and clamps as approved by the Town.

3.15 All non-metallic water and sewer lines shall be continuously marked using 12 gage or larger copper tracer wire secured to the top of the pipe with duct tape. End points shall be accessible by stobs or shall be brought to the surface at valves, fire hydrants, etc.

3.16 Install detectable tape in utility trench above all non-metallic pressure pipes in accordance with manufacturer’s recommendations. Install tape above pipe but not more than 23 inches deep along the side of the trench in such a manner as not to be broken or otherwise damaged during backfilling or compacting operations. Wrap tape around all valves, corporations stops and meter setters. Wrap tape three turns around base of fire hydrants and extend tape above against fire hydrants.

3.17 Construct sewer service connections from sewer line to property line as follows:

A. Place a tee fitting with 6-inch outlet in the sewer line where service connection is to be constructed. Lay 6 inch vitrified clay, precast concrete or PVC pipe from the tee to the property line on a grade of not less than ¼ in. per foot or lay ductile iron pipe on a grade of not less than 1/8 in. per foot. Close service connection at the property line with a water-tight plug. See Standard Details. 4 inch or 6 inch saddles, may be used in lieu of tees with Town’s approval.

B. Install service connections on existing sewer mains with a compression type cast iron saddle as manufactured by Pioneer or approved equal. Secure saddle to the pipe with a 24 gage stainless steel strap and two nickel-bronze T bolts. Make connections of this type by machine tapping or cutting the pipe. Use mastic sealer type gasket to insure a water-tight connection.

C. Determine the depth of service connections by the deepest of the following:

1. Provide 5 foot cover at the edge of the road paving or 15 feet from the center line of the street.

2. Provide 18 inch cover at the bottom of highway ditches unless protected by concrete ditch apron.

3. Provide 30 inch cover at the property line when property is above street.

4. Provide depth necessary for a 1 percent grade is required to provide service to a property.

5. Before construction of house connection field verify depth of sewer line and if any of the above conditions cannot be met, request instruction from the Engineer.

D. Place a 2 in. x 4 in. solid piece of lumber at the end of each service connection. The 2 in x 4 in. marker shall be set vertically and extend from invert to 6 in. above grade.

E. Construct concrete pedestals where shown on the Drawings and/or as directed by Engineer, in accordance with Standard Detail.

F. Provide ductile iron pipe or concrete encasement where cover over sewer is less than 3.5 feet in public roads or right-of-way.

3.18 Manholes shall be constructed to the elevations shown on the Drawings in accordance with the provisions of Standard Details.

A. Set manhole base section on bed of VDOT #57 stone to a minimum depth of 6 in. Stone shall be thoroughly compacted and carefully leveled.

B. Join all manhole riser and cone or flat slab top sections by the use of rubber gaskets.

C. Pack and brush joints in FRP lining in acid-resistant manholes with sealant to provide a watertight and acid-resistant seal. Field weld joints in PVC lining of acid-resistant manholes in accordance with manufacturer’s instructions.

D. Install pipe stubs in manholes where called for on the Drawings. All stubs shall extend 12” – 18” beyond the manhole and shall be sealed watertight with a plug or cap.

E. Install flexible manhole connections for all sewer pipe sizes 8 in. to 15 in., inclusive and apply sealant to completely fill joint between manhole barrel and flexible connections for the full thickness of the manhole barrel.

F. Plug lift holes and repair any defects in manhole.

G. Set adjusting rings in Portland cement mortar bed.

1. Rings will not be required out of paved roadways or walkways unless called for on the Drawings.

2. Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame by six inches.

H. Set manhole frame in bed of sealant. Bed shall consist of one, 3/8 in. bead laid flush with the inside edge of the frame base and another 3/8 in. bead laid flush with the outside edge of the frame base.

I. Bolt watertight manhole frames to manhole cone or flat slab top section as shown on the Standard Details where directed by Engineer or as shown on the Drawings.

J. Construct drop connections where called for on the Drawings.

1. Drop connection may be constructed of the same pipe material as used on the sewer line or may be constructed of ductile iron pipe and fittings.

2. Drop connections shall be encased in concrete except where ductile iron pipe and fittings are used.

K. Connections to existing manholes will be made as approved and as directed by the Town. Holes will be cut in manhole so connecting pipe will be radial to the manhole and at correct elevation. Cut pipe off flush with manhole inside diameter. Clean debris from around pipe and mortar gap so surface conforms to manhole inside surface. No sewage will be released or discharged on the ground.

L. Construct bench of concrete or brick and mortar

1. Lowest elevation of bench shall be at the spring line of the outgoing pipe.

 2. Slope bench three inches toward channel for drainage.

3. Where stubs or knockouts are provided for future pipe connections, bench shall be so formed.

4. Use sulfate resistant cement for concrete or mortar on all acid-resistant manholes.

3.19 Testing gravity sewer lines and manholes:

A. Sanitary sewer lines 24 in. in diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C8282 or the exfiltration method. Sewer lines larger than 24 in. diameter and manholes shall be tested by infiltration or exfiltration as hereinafter detailed. All sewer lines and manholes shall also be tested for final acceptance, using either the infiltration or exfiltration method as directed by and in the presence of the Engineer. Tests shall be conducted on short sections of sewer line, i.e., between manholes, or at the end of each days work. Provide all labor, materials, tools, and equipment necessary to make the tests. All equipment and methods used shall be acceptable to the Engineer. All monitoring gages shall be subject to the calibration, if deemed necessary.

B. Low-pressure air tests:

1. Summary of Method: Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.

2. Preparation of the sewer line: Flush and clean the sewer line prior to testing, thus serving to wet the pipe surface as well as clean out any debris. A wetted interior pipe surface will produce more consistent results. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested to resist the test pressure. Give special attention to laterals.

3. Ground Water Determination: Install a ½ inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.

4. Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828. The pressure-holding time is based on an average holding pressure of 3 psi gage or a drop from 3.5 psi to 2.5 pi gage.

 Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gage. After an internal pressure of the approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

 When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gage, commences the test. Before starting the test, the pressure may be allowed to drop to 3.5 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi gage during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop as not occurred.

 The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.

 If the pipe to be tested is submerged in ground water, the test pressure shall be increased to 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer.

5. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

 It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. In as much as a force of 250 lbs. is exerted on an 8 inch plug by a internal pipe pressure of 5 psi, it should be realized that sudden explosion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

 As a safety precaution, pressurized equipment shall include a regulator or relief valve set at perhaps 10 psi to avoid over-pressuring and damaging an otherwise acceptable line. No one shall be allowed in the manholes during the testing.

C. Manhole Exfiltration Test: All pipes leading to and from manhole shall be plugged. Plugs shall be inserted into the pipes a distance greater than the length of the plugs used to air test each respective section of the sewer line, so as to insure the manhole and sewer line tests overlap. Plugs shall be secured to the manhole structure. The manholes shall be filled with water to the top of frame and allowed to soak for a minimum of four hours to permit the manhole to absorb water. The cover shall be on the manhole during the soaking period. At the end of the soaking period, water shall be adde4d until the manhole overflows. No loss of water will be permitted over a four-hour period. Upon completion of the test, the water shall be removed from the manhole.

D. Vacuum Testing of Manholes

1. This test method is only applicable to precast concrete manholes and may be used in lieu of the manhole exfiltration test.

2. Manholes should be tested after assembly and prior to backfilling.

3. Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.

4. Installation and operation of vacuum equipment and indicating devices shall in accordance with equipment specifications for which performance information has been provided by the manufacturer and approved by the Office of Water Programs, Virginia Department of Health.

5. A measured vacuum of 10 inches of mercury shall be established in the manhole. The time for the vacuum to drop to nine inches of mercury shall be recorded.

6. Acceptance standards for leakage shall be established from the elapsed time for a negative pressure change from 10 inches to nine inches of mercury. The maximum allowable leakage rate for a four-foot diameter manhole shall be in accordance with the following:

 10 ft. or less 60 seconds

> 10 ft. but < 15 ft. 75 seconds

> 15 ft. but < 25 ft. 90 seconds

 For manholes five feet in diameter, add an additional 15 seconds and for manholes six feet in diameter, add an additional 30 seconds to the time requirements for four-feet diameter manholes.

7. If that manholes fails the test, necessary repairs shall be made and the vacuum tests and repairs shall be repeated until the manhole passes the test or the manhole shall be tested in accordance with the standard exfiltration test and rated accordingly.

8. If a manhole joint mastic is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic replaced.

E. Test for leakage of gravity sewers using either the infiltration or exfiltration test. Allowable leakage shall be 100 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2,400 gallons per mile per 24 hours. Gravity sewers under streams shall have zero infiltration.

1. Use infiltration test when ground water is at least 4 feet above pipe crown along entire length of line to be tested. Plug the pipe at the upper manhole. Install suitable measuring device at the next lowest manhole. Measuring the amount of water flowing through the outlet after flow has been stabilized.

2. Ground water Determination: Use same procedure as “low pressure air tests” above.

3. Use exfiltration test when ground water is less than 4 feet above the pipe crown. Plug the pipe at the lower manhole. Fill the line and manhole to 4 feet above pipe crown or top of manholes whichever is less. Let the water stand until pipe has reached maximum absorption and until all trapped air has escaped, 4 hour minimum. After maximum absorption is reached, refill manhole to original level. After 30 minutes, record difference in level and convert to gallons. Subtract manholes loss and obtain pipe line loss. Manhole loss is found by plugging inlet and outlet and filling manhole with water to 4 feet above pipe crown or top of manhole whichever is less. Let water stand one hour to reach maximum absorption. Refill to original level. After 30 minutes, check the difference in level and convert to gallons.

3.20 Disinfection of Water Lines

A. Disinfect and test water lines in accordance with AWWA Standard C651 and the following:

B. All water lines shall be disinfected prior to being in operation.

C. Prior to disinfection all water lines shall be flushed unless the tablet method of disinfection is used. All valves and hydrants shall be operated during this operation. Flushing velocities should not be less than 2.5 ft./sec.

D. Methods of Chlorine Application

1. Continuous feed method- Portable water shall be introduced into the pipe line at a constant flow rate. Chlorine shall be added at a constant rate of this flow so that the chlorine concentration in the water in the pipe is ay least 50 mg/l. The chlorinated water shall remain in the pipe line at least 24 hours after which the chlorine concentration in the water shall be at least 10 mg/l. All valves and appurtenances shall be operated while the chlorinated water remains in the pipe line.

2. Slug Method- Portable water shall be introduced into the pipe line at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100mg/l in a “slug” of the water. The chlorine shall be added long enough to insure that all portions of the pipe are exposed to the 100 mg/l chlorine solution for at least 3 hours. The chlorine residual shall be checked at regular intervals not to exceed 2000 feet to insure that adequate residual is maintained. As the chlorinated water passes valves and appurtenances, they shall be operated to insure disinfection of the appurtenances.

3. Tablet Method- This method shall not be used if non-portable water or foreign materials have entered the lines or if the water temperature is below 5⁰C (41⁰F).

 The tables shall be placed in each section and in all appurtenances. Enough tablets shall be used to insure that a chlorine concentration of at least 25 mg/l is provided in the water. They shall be attached by an adhesive to the top of the pipe sections and crushed or rubbed in all appurtenances. The adhesive shall be acceptable to the Bureau of Health. The velocity of the potable water in the pipe line shall be less than 1 ft./sec. The water shall then remain in contact with the pipe for 24 hours. All valves and appurtenances shall be operated while the chlorinated water is in the pipe line. Chlorine residuals shall be performed and recorded with Owner, Town of Warsaw, present.

E. Final Flushing – After the required retention period, the heavily chlorinated water shall be flushed from the lines using potable water.

F. Testing- After the lines have been flushed, the water lines shall be tested. At least two samples shall be collected at regular intervals, not exceeding 2000 feet throughout the length of pipe line.

1. All chlorine residual determinations shall be made using only those methods approved by the Office of Water Programs, Virginia Department of Health.

2. The water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipe, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedures must be repeated.

G. Maintain a copy of AWWA Standard C-600 and C651 on Project site during all disinfecting operations. An additional copy will be available for review in the off of the Town Engineer.

3.21 Acceptance Tests of Pressure Lines

A. Supply the pumps, calibrated gages and meters, and all the necessary apparatus for the test. Notify the Owner and Engineer at least 48 hours in advance of the test date and perform tests in presence of Engineer.

B. Owner will supply water at no cost for one test of potable water lines only; all other water will be supplied by the Contractor at his own cost.

C. After the line has been backfilled and at least seven days after the last concrete reaction anchor has been poured, subject the line or any valved section of the line to a hydrostatic pressure test in accordance with AWWA C651, except as modified herein. Fill the system with water at a velocity of approximately 1 ft. per sec. while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 1.5 x the working pressure. Test pressures shall: (1) Not be less than 1.25 x the working pressure at the highest point along the test section, (2) not exceed thrust restraint pressure, (3) not vary by more than + of – 5 psi, (4) not exceed twice the rated pressure of the valves or hydrants when test includes closed gate valves, (5) not exceed rated pressure of valves in resilient-seated butterfly valves are used, (6) shall be at least 100 psig as measured at the high point on the Section of line under tests. Measure pressure at the low point on the system compensating for gage elevations. Maintain this pressure for two hours. If pressure cannot be maintained, determine cause, repair and repeat the test until successful.

D. A leakage test shall be conducted concurrently with the pressure tests in accordance with AWWA c600, except as modified herein. Leakage shall be determined with a calibrated test meter, furnished by the Owner. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe filled with water. Leakage shall not exceed 10 gallons per day per mile per inch of diameter. If leakage exceeds that specified, find and repair the leaks and repeat the test until successful.

E. All visible leaks shall be repaired regardless of the amount of leakage.

END OF SECTION

**CAST-IN-PLACE CONCRETE**

**1.0 GENERAL**

1.1 Description

A. Work includes the forming, reinforcing, measuring, transporting, and placing finishing of cast-in-place concrete, integral water stops and/or water bars.

1.2 Related requirements specified in other Sections of the Specifications:

 A. Built-in anchors, inserts and bolts for connection for other materials

 B. Built-in sleeves, pipes, conduits, thimbles, and dovetail slots.

1.3 Reference Standards and Specifications are referred to by abbreviations as follows:

 A. American Concrete Institue……………………………………….ACI

 B. American Society for Testing & Materials………………….ASTM

C. Concrete Reinforcing Steel Institute…………………………..CRSI

1.4 Quality Assurance

A. In addition to complying to all pertinent codes and regulations, comply with all pertinent recommendations contained in:

1. Guide for Measuring, Mixing, Transporting and Placing Concrete - ACI Standard 304R-00.

2. Hot Weather Concreting – ACI Standard 305R-99

3. Cold Weather Concreting – ACI Standard 306R-88

4. Building Code Requirements for Structural Concrete and Commentary – ACI Standard 318-08

5. Guide to Framework for Concrete – ACI Standard 347-04

6. Code Requirements for Environmental Engineer Concrete Structures and Commentary – ACI Standard 350-06

7. CRSI Placing Reinforcing Bars, 8th Edition.

8. CRSI Manual of Standard Practice

9. Specifications for Ready-Mix Concrete – ASTM C94.

B. Maintain one complete set of Codes and Standards on project site during all concreting operations.

1.5 Submittals

 A. Shop Drawings:

1. Submit Drawings showing sized and dimensions for fabrication and placing of reinforcing steel and bar supports.

2. Indicate bar schedule, stirrup spacing and diagrams of bent bars.

3. Submit Drawings showing placement of all items of work to be installed but specified elsewhere.

B. Submit concrete design mix and test reports of concrete compression, yield, air content and slump test.

C. Submit manufacturer’s literature on the following:

 1. Concrete admixtures

 2. Water stops

 3. Metal screen joint

D. Submit delivery tickets for any ready-mix concrete delivered to the job site per ASTM C94.

1.6 Product Delivery, Storage and Handling

A. Deliver reinforcements to project site in bundles marked with metal tags indicating bar size, length and/or bar number.

B. Store and bundle reinforcement so as to prevent contamination.

C. Deliver, store and handle all other concreting materials in accordance with the cited Codes and Standards.

**2.0 PRODUCTS**

2.1 Concrete work shall meet requirements of the current edition of ACI 301 with the following modifications.

A. Cement for concrete shall be ASTM C150 of the following types:

1. Except where otherwise designated, cement shall be Type I or Type II.

2. Cement for water retention structures shall be Type II.

3. Where designated on the Drawings, cement shall be Type III. (Strength shall be obtained in 7 days).

B. The 28 day compressive strength of concrete for this project shall be as follows:

1. Class “A”, 4000 psi for all structures, not designated on the Drawings.

2. Class “B”, 3000 psi for those uses designated on the Drawings.

3. Class “C” 2000 psi for concrete under structural base slabs, cradles, encasements and those uses designated on the Drawings.

C. All exterior concrete permanently exposed to the weather of designated to be waterproof concrete, shall be air-entrained concrete.

D. No admixtures will be permitted except for air-entraining admixtures, water reducing admixtures integral waterproofing, and possolans. Water reducing admixture used must be approved in writing by the Engineer.

E. Proportioning of ingredients shall be by Method 1 or 2.

F. The minimum cement content shall be 6.25 bags per cubic yard of concrete.

G. Earth cuts may be sued as forms for footings only.

H. Minimum strength of concrete before reshoring shall be 2600 psi.

I. Reinforcing steel shall be ASTM A615 Grade 60. Welded wire fabric shall be ASTM A185.

J. Welding or heated field bending of rebars shall be permitted only by written permission of Engineer.

K. Isolation joint material shall be the thickness shown and shall meet requirements of ASTM D1752.

L. Expansion joint filler shall be rubber expansion joint filler as manufactured by APS Supply Company. Joint sealant, for sealing joints over expansion joint filler, shall be Sika Corporation Sikaflex 2c SL. Surfaces receiving joint sealant shall be prepared using Sika Corporation Sikaflex 429 Sealant/Adhesive Primer.

M. (6.3) Water stops shall be polyvinylchloride. Material shall meet the requirements of Corps of Engineers Specifications CRD-C-572. Joints shall be spliced by heat fusion or adhesion as recommended by the manufacturer. Construction joints shall have 6 in. x 3/8 in. waterstops with large bulb. Expansion joints shall have 9 in. x 3/8 in. x 5/8 in. waterstops.

2.2 Grout for setting column and machine bases and leveling plates shall be premixed and non-corrosive and shall meet the requirements of the Corps of Engineers Specifications for nonshrink grout CRD-C-588.

2.3 Expansion type anchor bolts shall be Hilti Corp. Stainless steel Expansion Anchor Kwik Bolt TZ. Bolts shall be of a length and diameter as noted on the Drawings.

2.4 Joint sealant shall be Sika Corporation Sikaflex 2c SL self-leveling joint sealant for horizontal surfaces, and Sika Corporation Sikaflex 2 c NS EZ Mix for inclined non-level surfaces. Surfaces receiving joint sealant shall be prepared using Sika Corporation Sikaflex 429 Sealant/ Adhesive Primer.

**3.0 EXECUTION**

3.1 Concrete Framework shall meet requirements of ACI 347-78.

3.2 Concrete work shall meet requirements of the current edition of ACI 301 with the following modifications and supplements.

A. All formed concrete which will be exposed to public view shall receive grout cleaned finish.

B. All formed concrete surfaces to receive waterproofing shall have a smooth form finish.

C. All interior flat cement finished surfaces of floors, steps, platforms, etc. shall be finished by screeding and finished with wood float or steel trowel as the Engineer may prescribe. Exterior slabs, steps and sidewalks shall have a broom finish. Sidewalks shall be edged.

D. Membrane curing compounds shall not be used on concrete surfaces which are to receive floor hardener or additional finish materials.

E. The “Recommended Practice for Hot Weather Concreting”, ACI 305, and “Recommended Practice for Cold Weather Concreting”, ACI 306, are made a part of this specification.

F. When in the opinion of the Engineer there is a possibility of the surrounding air temperature falling below 40 Deg. F.’ he may require additional specimens to be cured under job conditions.

3.3 Concrete Tests: During the progress of the work compression tests specimens shall be made and cured in accordance with the “Standard Method of Making and Curing Concrete Compression and Flexture Text Specimens in the Field” (ASTM Designation: C-31).

A. Not less than three specimens shall be made for each test, nor less than one test for each 50 cu. Yds. Of concrete of each class except that at least one test shall be made for each day in which more than 5 cu. Yds. Of any class of concrete is poured.

B. Specimens shall be cured under laboratory conditions except that when, in the opinion of the Engineer, there is a possibility of the surrounding air-temperature falling below 40⁰ F., he may require additional specimens to be cured under job conditions.

C. Specimens shall be tested in accordance with the “Test for Comprehensive Strength of Cylindrical Concrete Specimens” (ASTM Designation: C-39). One specimen of each test shall be tested for maximum comprehensive strength at 7 days with the other two being tested at 28 days.

D. The cost of testing shall be included by the Contractor in the Various contract prices to be paid and no separate payment therefore will be paid.

3.4 Reinforcing Steel

 A. Reinforcing steel splices shall be as follows:

 1. No. 3 and No. 4 bars – 16 inches

 2. No. 5 and Larger – Class “C” Splice.

B. Placement of reinforcement and accessories shall be in accordance with CRSI Placing Reinforcing Bars, 8th Edition and CRSI Manual of Standard Practice.

C. All reinforcement within the limits of a day’s pour shall be in place and the Engineer shall be notified in sufficient time to permit inspection before concreting begins.

3.5 Grout for floor slab toppings of water retention structures shall be a mix of sand and ASTM (c150 Type II cement combined at a ratio of three parts sand (maximum) to one part cement.

3.6 Preformed metal screen joint shall be 24 gage galvanized steel shaped to provide a keyed joint and shall have dowel knockouts as required for dowels shown on the Drawings. Joint shall be furnished with stakes, splice plates and all other accessories necessary for complete installation.

END OF SECTION